

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/05906 A1

- (51) International Patent Classification⁷: C09K 5/20, (74) Agents: GREEN, Mark, Charles et al.; Urquhart-Dykes & Lord, 30 Welbeck Street, London W1M 7PG (GB).
C23F 11/12
- (21) International Application Number: PCT/EP00/05661 (81) Designated States (*national*): AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 20 June 2000 (20.06.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 99305665.4 16 July 1999 (16.07.1999) EP (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): TEX-ACO DEVELOPMENT CORPORATION [US/US]; 2000 Westchester Avenue, White Plains, NY 10650 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): MAES, Jean-Pierre [BE/BE]; Burgemeester De Guchteneerelaan 36, B-9820 Merelbeke (BE). ROOSE, Peter [BE/BE]; Antoon de Pesseroeylaan 18, B-9831 Sint-Martens-Latem (BE).

Published:

— With international search report.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYNERGISTIC COMBINATIONS OF CARBOXYLATES FOR USE AS FREEZING POINT DEPRESSANTS AND CORROSION INHIBITORS IN HEAT TRANSFER FLUIDS

(57) Abstract: Aqueous coolants and heat transfer fluids are disclosed. The compositions comprise aqueous solutions of a mixture of a C₁-C₂ carboxylate salt with a C₃-C₅ carboxylate salt. A C₆-C₁₂ acid may also be added to the mixture. The aqueous compositions may further comprise a hydrocarbyl triazole and thiazole. The aqueous compositions have good heat transfer properties, low freezing points and low corrosion properties.

WO 01/05906 A1

BEST AVAILABLE COPY

SYNERGISTIC COMBINATIONS OF CARBOXYLATES FOR USE AS FREEZING
POINT DEPRESSANTS AND CORROSION INHIBITORS IN HEAT TRANSFER
FLUIDS

FIELD OF THE INVENTION

The present invention relates to aqueous heat transfer fluids particularly antifreeze coolants and general cooling fluids that provide both frost protection and corrosion protection by use of synergistic combinations of carboxylic acids. The heat transfer fluids of this invention are non-toxic, environmentally friendly and provide improved heat-transfer properties, compared to traditional glycol based coolants and heat-transfer fluids. Improved corrosion protection is obtained compared to formate and acetate based heat transfer fluids using conventional corrosion inhibitors. The heat transfer fluids of the present invention can be used in any heat-exchange application including industrial heat-exchangers, refrigeration- and cooling systems, cooling towers, open and closed heat exchangers and for cooling internal combustion engines. The fluids protect the equipment from frost and corrosion damage.

BACKGROUND OF THE INVENTION

Effective Heat Exchange

Heat transfer fluids, whether used for heat-transfer in industrial or automotive applications have been, almost without exception, water-based. The efficiency of a heat transfer fluid to transport heat away from heat producing surfaces can be expressed in terms of the specific heat and thermal conductivity of the fluid. Specific heat of a substance is the

-2-

ratio of its thermal capacity to that of water. The thermal capacity is the quantity of heat necessary to produce unit change of temperature in unit mass. Thermal conductivity of a substance is the time rate of transfer of heat by conduction through a mass of unit thickness, across a unit area for a unit difference of temperature. Viscosity of the heat transfer fluid is also a factor in evaluating the overall heat exchange efficiency - a better fluidity will contribute to an effective heat transport. Compared to most other heat-transfer fluids, water has the highest specific heat, the highest thermal conductivity and lowest viscosity. Whilst water is a most effective heat transfer fluid, it does not provide the required freezing and corrosion protection.

Freezing Point Depressant

Heat transfer fluids and engine coolants are known that contain high concentrations of inorganic salts to depress the freezing point. Calcium chloride is an example of the salts used to that purpose. Like other inorganic salts used for frost protection, it is extremely corrosive and corrosion cannot be adequately prevented by inhibitors. Another disadvantage of such coolants is that at very low temperatures, the solubility of inorganic salts is reduced. These drawbacks limit the use of inorganic salts as freezing point depressants in water.

Petroleum products, such as kerosene, have also been used in heat-exchange and cooling systems as a total replacement for water, but their adverse effect on rubber hoses, poor heat-transfer, and flammability has made their use impractical. Organic hydroxy compounds were found more reliable and ethylene glycol came into widespread use. Other heat transfer fluid

bases included glycerol, the lower boiling point alcohols such as methanol, and propylene glycol. Of these only propylene glycol is still under active consideration because of its low toxicity compared to ethylene glycol. In general, water/glycol mixtures are used today because they are chemically stable and compatible with the elastomers and plastics used in heat-exchange systems. In addition, they provide cost efficient freezing and boiling protection and can be formulated with inhibitors to provide the required corrosion protection. However, ethylene glycol is preferred as a heat transfer fluid base because of its high boiling point and flash point compared to methyl alcohol, its lower viscosity (better fluidity) and low cost compared to propylene glycol. Propylene glycol is used in applications where a lower toxicity is desirable. The heat-exchange capacity of water/freezing point depressant solutions is reduced with increasing freezing point depressant content.

Pure water remains a better heat transfer fluid compared to any mixture of ethylene- or propylene glycol. A compromise between the required freezing protection and heat exchange efficiency has to be made. Aqueous glycol solutions have higher viscosities at higher glycol concentrations. A better fluidity is thus obtained in solutions containing less freezing point depressant. Alkali salts of low molecular organic acids such as alkali metal acetate and alkali metal formate can also provide frost protection when dissolved in water. Compared to glycol, acetate and formate solutions have improved heat-transfer properties and lower viscosities, for a same level of frost protection. They are also more environmentally friendly than glycols. Formate and acetate based fluids have found

-4-

applications as heat-exchange fluid and airport runway deicing fluids. US Patent 5,104,562 describes a coolant composition containing a potassium formate and potassium acetate.

Corrosion Protection

Corrosion in heat-exchange- and engine cooling systems will have two main effects: deterioration of the metal component either by uniform wastage or localised attack (pitting, crevice corrosion), and the production of insoluble corrosion products that will tend to block heat-exchangers, thermostat valves, filters and other components and to impede heat transfer by deposition on heat exchange surfaces. Regardless of the composition of the freezing point depressant, corrosion inhibitors are needed to reduce and control corrosion of the metals in contact with the fluid.

DISCLOSURE OF THE INVENTION

One aspect of the invention is that specific aqueous solutions of organic carboxylates show very low freezing points at eutectic compositions i.e. compositions mixed in such proportions that the freezing-point is a minimum, the constituents freezing simultaneously. This is very important, as the total organic salt content can be significantly reduced compared with conventional monocarbon carboxylates (formate or acetate) systems offering the same frost protection. The advantage is not only in improved economics but also, in better heat-transfer due to a higher specific heat and improved fluidity resulting from the higher water content at the same frost protection. In particular, it has been found that solutions of low carbon (C_1 - C_2) carboxylic acid salts, in

-5-

combination with higher carbon (C_3 - C_5) carboxylic acid salts, provide synergistic frost protection. Very effective eutectica have been found for the combination of the alkali salts of a C_1 carboxylic acid (methanoic- or formic acid) and a C_3 carboxylic acid (propanoic- or propionic acid).

Another aspect of the present invention is that improved synergistic frost protection and corrosion protection is found by adding one or a plurality of C_6 - C_{12} carboxylic acids. It has been found that higher carbon carboxylates (C_{12} - C_{16}) also increase the corrosion protection, but their solubility in the salt solutions is very limited. Optionally the addition of hydrocarbyl triazoles or thiazoles can further improve the corrosion protection.

DETAILED DESCRIPTION AND EXAMPLES

Synergistic Frost Protection in Solutions of Lower Carbon (C_1 - C_2) and Higher Carbon (C_3 - C_5) Carboxylic Acid Salts

The freezing point of carboxylate mixtures according to this invention are much lower than expected in comparison to freezing point reduction as determined separately for each component. Preferred ratios are from 3:1 to 1:3, preferably 1:1. This may be demonstrated by experimental data on aqueous mixtures of potassium formate (C_1) and sodium propanoate (C_3). Table 1 shows the results of freezing point determinations for different solutions of the C_1 and C_3 carboxylates.

TABLE 1

Weight Ratio Potassium Formate (C ₁): Sodium Propanoate (C ₃) Water 100	Freezing Temperature °C
40:0	-36
35:5	-38
30:10	-42
20:20	-48
25:15	-45
0:40	-32

The pure solution of potassium formate (40:0) in water has a freezing point of -36°C. The same concentration of sodium propanoate (40:0) in water has a freezing point of -32°C. In mixtures of the two components a freezing point below -48°C is found at a ratio 20:20, which is remarkably lower than the expected mid-point of -34°C calculated using the addition rule. The laws of molecular freezing point depression are apparently no longer valid for this type of solution. The combination of the added organic salts seem to interfere with the solidification of water to ice crystals in a way that it inhibits the possibility to obtain a regular crystal structure in the water molecules. Without being bound by theory, it is also believed that the selected cations play an important role in the synergistic freezing point depression. Substitution of the sodium by potassium in the propanoate does not yield as great a frost protection effect. Thus a most preferred system is the combination of a C₁ potassium carboxylate salt and a C₃ sodium carboxylate salt.

-7-

Similar synergistic effects are found when combining other solutions of differing carbon number e.g. aqueous mixtures of acetate salts (C_2) and butyrate salts (C_4).

Further Improved Synergistic Frost Protection and Corrosion Protection upon Addition one or more C_6 - C_{12} Carboxylic Acids to Aqueous Solutions of Low Carbon (C_1 - C_5) and Higher Carbon (C_3 - C_5) Carboxylic Acid Salts

The use of C_6 - C_{12} carboxylates as corrosion inhibitors has been investigated in aqueous solutions of low carbon (C_1 - C_2) and higher carbon (C_3 - C_5) carboxylic acid salts used as freezing point depressants. Different combinations of conventional inhibitors such as borax, benzoates, molybdates and nitrites are currently used with hydrocarbyl triazole for corrosion protection in acetate and formate salt solutions. Some of these inhibitors are toxic and harmful to the environment. Others are not very stable in organic salts solutions and may precipitate out of solution under conditions of high temperatures or severe frost. By using C_6 - C_{12} carboxylate inhibitors in C_1 - C_5 carboxylate freezing point depressant solutions at from 1 to 10%, it has been found that these problems may be resolved. Overall stability of the product is improved. A further synergistic improvement of the frost protection properties was found. On their own, C_6 - C_{12} carboxylates are poor freezing point depressants. The addition of small amounts of C_6 - C_{12} acids to the combination of acids further improves the frost properties, significantly far beyond what could be expected. Table 2 shows the freezing point depression gained by the addition of 5% sodium heptanoate (C_7).

TABLE 2

Weight Ratio Potassium Formate (C ₁): Sodium Propanoate (C ₃): Sodium Heptanoate (C ₇) Water 100	Freezing Temperature °C
40:0:5	-42
35:5:5	-46
30:10:5	-49
20:20:5	n.d.*
25:15:5	-50
0:40:5	n.d.*

A comparison between the corrosion protection of different low carbon containing organic acid salts solutions with traditional inhibitor packages and the newly developed synergistic combinations of carboxylate based solutions shows that there is a significant improvement in corrosion protection.

The present invention will be described with reference to the following non-limiting examples. Tables 3 and 4 show the results of corrosion tests.

EXAMPLESComparative Example A (Traditional Formate-Based Formulation)

One litre of an aqueous antifreeze formulation was prepared comprising of 320 g potassium hydroxide, 275 ml formic acid (98%), 15 g sodium benzoate and 2 g tolyltriazole pH = 8.8.

* : not determined (freezing point is below -50°C)

Invention Example 1

One litre of an aqueous formulation was prepared comprising of 320 g potassium hydroxide, 275 ml formic acid (98%), 13 g 2-ethylhexanoic acid, 1 g sebacic acid, 0.8 g tolyltriazole and 4 g sodium hydroxide, adjusted to pH 9.

Invention Example 2

One litre of an aqueous antifreeze formulation was prepared comprising of 115 g potassium hydroxide, 110 ml formic acid (98%), 200 g sodium propanoate, 16.2 g 2-ethylhexanoic acid, 1.26 g sebacic acid, 1.0 g tolyltriazole and 4 g sodium hydroxide, adjusted to pH 9.

Comparative Example B (Traditional Acetate-Based Formulation)

One litre of an aqueous antifreeze formulation was prepared comprising of 400 g potassium hydroxide, 60 ml formic acid (98%), 360 ml acetic acid (99.5%), 800 ml water, 5 g sodium benzoate and 1 g benzotriazole.

Invention Example 3

One litre of an aqueous antifreeze formulation was prepared comprising 400 g potassium formate, 16.2 g 2-ethylhexanoic acid, 1.26 g sebacic acid, 1.0 g tolyltriazole and 4 g sodium hydroxide, adjusted to pH 8.8.

Invention Example 4

One litre of an aqueous formulation was prepared comprising of 115 g potassium hydroxide, 110 ml formic acid (98%), 200 g sodium propanoate, 13 g 2-ethylhexanoic acid, 1 g sebacic acid, 0.8 g tolyltriazole and 4 g sodium hydroxide, adjusted to pH 8.2.

TABLE 3Glassware Corrosion Tests - 336 Hours - similar to ASTM D1384

		Weight loss (mg/coupon)					
		Copper	Solder	Brass	Steel	Iron	Aluminium
(Comparative)	Ex. A	9.9	115.4	1.2	4.0	174.5	-0.1
(Invention)	Ex. 1	2.9	88.2	2.8	38.6	96.3	-3.2
(Invention)	Ex. 2	3.0	79.8	2.5	12.4	19.8	

TABLE 4Aluminium Hot Corrosion Test Similar to ASTM D4340

	Formulation	Weight loss on aluminium coupon (mg/cm ² /week)
(Invention).	Ex. 1	0.51
(Comparative)	Ex. B	7.01
(Invention)	Ex. 3	1.54
(Invention)	Ex. 4	1.47

It is seen that the examples according to the present invention show a reduction in weight loss of many metals, e.g. copper, solder and iron. The weight loss on aluminium coupons (Table 4) is significant as aluminium is a major component of automotive engines.

CLAIMS

1. An aqueous fluid composition for use as a heat transfer fluid comprising a mixture of a C₁-C₂ carboxylic acid salt and a C₃-C₅ carboxylic acid salt.
2. A composition as claimed in Claim 1 further comprising a C₆-C₁₂ carboxylate.
3. A composition as claimed in Claim 1 or Claim 2 further comprising a hydrocarbyl thiazole or hydrocarbyl triazole.
4. A composition as claimed in any preceding claim wherein the ratio of C₁-C₂ carboxylic acid salt to C₃-C₅ carboxylic acid salt to from 3:1 to 1:3.
5. A composition wherein the ratio of C₁-C₂ carboxylic acid salt to C₃-C₅ carboxylic acid salt is 1:1.
6. A composition wherein the C₁-C₂ carboxylic acid salt is potassium.
7. A composition wherein the C₃-C₅ carboxylic acid salt is sodium.
8. A composition as claimed in any one of Claims 2 to 7 wherein the C₆-C₁₂ carboxylate is present in solution at from 1 to 10 wt %.

-12-

9. A composition as claimed in any one of Claims 2 to 8 comprising a mixture of potassium formate, sodium propanoate and sodium heptanoate.

10. A composition as claimed in Claim 10 in a ratio of 20:20:5 respectively.

11. A composition as claimed in any preceding claim having a pH of from 8 to 9.5.

12. The use of a composition as claimed in any preceding claims as a coolant composition.

13. The use of a composition as a coolant composition in automotive engines.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/05661

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C09K5/20 C23F11/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C09K C23F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 26 53 448 A (BP CHEM INT LTD) 7 July 1977 (1977-07-07) page 4, line 11 -page 5, line 16 page 7, line 23 -page 8, line 3 claims 1,2,4	1
A	DE 26 53 449 A (BP CHEM INT LTD) 8 June 1977 (1977-06-08) page 4, line 11 -page 5, line 16 page 8, line 6 - line 9 claims 1,2,4	1,3
A	CA 2 220 315 A (DOW CHEMICAL CO) 17 June 1998 (1998-06-17) the whole document	1,3
-/-		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

9 October 2000

Date of mailing of the international search report

16/10/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Puetz, C

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 00/05661

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 104 562 A (KALMAN TIBOR ET AL) 14 April 1992 (1992-04-14) cited in the application the whole document ----	1,3,6, 12,13
A	WO 96 26990 A (KALMAN TIBOR ; KARDOS PETER (HU); KERTI JOZSEF (HU); KERTI JOZSEFNE) 6 September 1996 (1996-09-06) the whole document ----	1,3,6, 12,13
A	GB 2 046 748 A (VERDUGT BV) 19 November 1980 (1980-11-19) the whole document -----	1,6,7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/05661

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2653448 A	07-07-1977	GB 1505388 A	30-03-1978
		CA 1066617 A	20-11-1979
		FI 763155 A,B,	28-05-1977
		NL 7612828 A,B,	01-06-1977
		NO 763788 A	31-05-1977
		SE 425455 B	04-10-1982
		SE 7612196 A	28-05-1977
		US 4220661 A	02-09-1980
		AU 1963276 A	25-05-1978
		BE 848712 A	24-05-1977
		BR 7607815 A	11-10-1977
		DD 127475 A	28-09-1977
		DE 2653449 A	08-06-1977
		DK 530276 A,B,	28-05-1977
		DK 530376 A	28-05-1977
		FI 763154 A,B,	28-05-1977
		FR 2332764 A	24-06-1977
		IE 43961 B	15-07-1981
		IT 1203038 B	15-02-1989
		JP 1145271 C	12-05-1983
		JP 52070993 A	13-06-1977
		JP 57035852 B	31-07-1982
		JP 1188031 C	30-01-1984
		JP 52110286 A	16-09-1977
		JP 58011921 B	05-03-1983
		LU 76270 A	10-07-1978
		NL 7612827 A,B,	01-06-1977
		NO 144557 B	15-06-1981
		NO 763789 A,B,	31-05-1977
		SE 424805 B	16-08-1982
		SE 7612195 A	28-05-1977
		US 4179522 A	18-12-1979
		ZA 7606293 A	30-05-1978
DE 2653449 A	08-06-1977	GB 1505388 A	30-03-1978
		AU 1963276 A	25-05-1978
		BE 848712 A	24-05-1977
		BR 7607815 A	11-10-1977
		DD 127475 A	28-09-1977
		DE 2653448 A	07-07-1977
		DK 530276 A,B,	28-05-1977
		DK 530376 A	28-05-1977
		FI 763154 A,B,	28-05-1977
		FR 2332764 A	24-06-1977
		IE 43961 B	15-07-1981
		IT 1203038 B	15-02-1989
		JP 1145271 C	12-05-1983
		JP 52070993 A	13-06-1977
		JP 57035852 B	31-07-1982
		JP 1188031 C	30-01-1984
		JP 52110286 A	16-09-1977
		JP 58011921 B	05-03-1983
		LU 76270 A	10-07-1978
		NL 7612827 A,B,	01-06-1977
		NL 7612828 A,B,	01-06-1977
		NO 144557 B	15-06-1981
		NO 763789 A,B,	31-05-1977
		SE 424805 B	16-08-1982

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/EP 00/05661

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2653449 A		SE 7612195 A US 4179522 A ZA 7606293 A	28-05-1977 18-12-1979 30-05-1978
CA 2220315 A	17-06-1998	NONE	
US 5104562 A	14-04-1992	NONE	
WO 9626990 A	06-09-1996	HU 76029 A AU 4888696 A CZ 9702694 A SK 118397 A	30-06-1997 18-09-1996 13-05-1998 14-01-1998
GB 2046748 A	19-11-1980	NL 7902506 A DE 3011306 A FR 2452474 A	02-10-1980 09-10-1980 24-10-1980

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ BLACK BORDERS

☒ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES

☐ FADED TEXT OR DRAWING

☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING

☐ SKEWED/SLANTED IMAGES

☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS

☐ GRAY SCALE DOCUMENTS

☐ LINES OR MARKS ON ORIGINAL DOCUMENT

☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY

☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.